

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

In the Matter of

Amendment of Parts 2 and 15
of the Commission's Rules to Permit
Use of Radio Frequencies Above 40 GHz
for New Radio Applications

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ET Docket No. 94-124
RM-8308

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MOTION TO ACCEPT LATE-FILED COMMENTS

Apple Computer, Inc. ("Apple"), pursuant to Section 1.46 of the Commission's Rules, respectfully requests that the attached comments be made a part of the record in the above-captioned proceeding, even though they are being filed one day after the deadline. The delay was caused by difficulties in finalizing Apple's comments and in transmitting those comments from Apple's offices in California to the undersigned.


Unlicensed data communications services hold great significance for Apple. Apple has participated extensively in the Commission's PCS proceeding, as well as in other proceedings dealing with allocations for unlicensed Data-PCS devices specifically, and for unlicensed devices generally. The attached comments will provide the Commission with a more complete record on which to base its decision, and the brief delay in submitting these comments will not prejudice the interests of other parties.

For these reasons, Apple asks that the Commission grant this motion.

Respectfully submitted,

APPLE COMPUTER, INC.

By:



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January 31, 1995

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COMMENTS OF APPLE COMPUTER, INC.

Apple Computer, Inc. ("Apple") hereby submits its comments in response to the Federal Communications Commission's (the "FCC" or "Commission") Notice of Proposed Rule Making (the "NPRM") in the above-referenced proceeding, released November 8, 1994. In this proceeding, the FCC proposes to make available a total of 18 GHz of spectrum, in the frequency range between 47.2 and 153 GHz (the millimeter ("mm") wave bands), for non-government users. In particular, the NPRM proposes to allocate 8.5 GHz of bandwidth for general unlicensed operations.

The Commission's recognition of the need for high-bandwidth, short-range radio communications is both welcome and timely. As indicated in the NPRM, current spectrum allocations and existing and proposed services leave certain voids, particularly in meeting demand for short-range applications that require very high bandwidth or data transfer rates, such as wireless participation in the National Information Infrastructure (NII), wireless access to medical, educational, and other information, and other information-intensive applications.¹ The NPRM's proposed 8.5 GHz allocation for general unlicensed operations, together with its recognition that only limited regulations would be required for these new unlicensed bands, would make it possible for providers and users to augment existing technologies and services to create a complete fabric of wireless capabilities.

¹ NPRM at ¶ 2.

As the NPRM recognized, however, development of millimeter wave technologies will not occur overnight.² Moreover, millimeter wave frequencies have certain attributes — such as their limited propagation — that make them suitable for certain types of communications, but not for others.³ As a result, the Commission should consider these frequencies to be a complement to unlicensed allocations in the lower frequency bands, and should continue to develop the lower-frequency bands in order to satisfy existing demand, support the deployment of proven technologies, and provide capabilities that cannot be met using the millimeter wave bands.

I. THE COMMISSION’S PROPOSED ALLOCATION PLAN WILL SERVE THE PUBLIC INTEREST BY MAKING SUITABLE AMOUNTS OF SPECTRUM AVAILABLE FOR LICENSED AND UNLICENSED OPERATIONS.

In the NPRM, the Commission struck a reasonable balance between the need for spectrum devoted to licensed services and the need for spectrum devoted to unlicensed services, including vehicular radar systems. In addition, it recognized the unique suitability of the millimeter wave bands for providing certain unlicensed services.⁴

Experience with existing unlicensed allocations demonstrates the wisdom of the Commission’s generous proposed allocation for unlicensed services. The development and deployment of Part 15 devices shows that when the rules are reasonable and the spectrum allocation is bountiful, manufacturers and service providers are able to develop a wide range of services, including many that could not have been predicted at the time the allocation was made and the rules were adopted.

While the unlicensed mm wave bands will support a wide range of communications services, their greatest benefits will be realized in supporting new wireless computing applications. Given the very limited existing allocations for unlicensed operations, including unlicensed data communications, those using unlicensed data communications products have become accustomed to operating as second- or third-class inhabitants of interference-laden frequency

² NPRM at ¶ 4.

³ NPRM at ¶ 8, 9.

⁴ NPRM at ¶ 18; see also NPRM at ¶¶ 14-15.

bands, who are tolerated by primary services only to the extent that they are invisible (and thus dangerously close to ineffective).

With the advent of “clean” mm wave bands for unlicensed communications, more exciting applications supporting high-bandwidth data communications will become possible. The mm wave allocation will enable equipment and service providers to meet the communications needs of computer users, who to date have been provided increasingly large amounts of computing power without a corresponding increase in available communications bandwidth.⁵

Access to a lightly-regulated unlicensed band may also spur the development of licensed services by providing a path for the initial or experimental deployment of systems whose commercial revenue potential has yet to be proved.⁶ Services that might otherwise be provided on a licensed basis can be provided on an unlicensed basis, as long as the equipment being used complies with the technical rules governing the unlicensed band and the service does not require the level of protection associated with a licensed service. In the case of the mm wave bands generally and the “oxygen absorption band” (in the 59-64 GHz range) in particular, both the exclusivity and protection from interference that would normally be secured by licensing are provided by the very limited distances that signals at those frequencies are able to travel.

Apple therefore supports the Commission’s proposal to allocate 8.5 GHz, of the total 18 GHz, for general unlicensed use.

⁵ The nomenclature and vision of “ubiquitous computing” has been most eloquently developed by Mark Weiser of Xerox PARC, who suggests that individuals may eventually use hundreds of computing devices per person. Weiser also calls attention to the doubling of practical personal computers’ capabilities each year, and the inevitable demand for yet-increasing communications bandwidth required to exploit these devices for our benefit. See Mark Weiser, “Some Computer Science Problems in Ubiquitous Computing,” Communications of the ACM, July 1993 at 75-81 (also reprinted as “Ubiquitous Computing,” Nikkei Electronics, December 6, 1993 at 137-143); see also Mark Weiser, “The Computer for the 21st Century,” Scientific American, September 1991 at 94-104.

⁶ The proposed allocation of adjacent spectrum for licensed and unlicensed services could also expedite equipment development and reduce hardware costs, as well as facilitate the deployment of multi-functional devices capable of both licensed and unlicensed operation.

II. THE COMMISSION SHOULD ADOPT THE PROPOSED MINIMALLY-RESTRICTIVE RULES FOR THE UNLICENSED MM WAVE BANDS.

Simplicity is the most important measure of the suitability of operational and band-access rules for unlicensed devices. As a general rule, the more latitude provided for engineering innovation, the more quickly and inexpensively unlicensed services (in the mm bands or elsewhere) can be deployed.⁷

The minimal Part 15 rules proposed in the NPRM approach the optimum and should ease the path towards full utilization of the mm band frequencies. Industry's response to the opening of these frequencies will depend upon the progress of commercial radio technology, which in turn will depend upon the degree of technical flexibility permitted under the rules. The laws of physics will already pose difficulties for those developing products capable of operating in the mm wave bands. The Commission should not create additional impediments that will unnecessarily delay the introduction of new technologies and services.

As was true for spread spectrum products, mm wave products will not develop overnight.⁸ Yet once the technologies are brought to commercialization — a result that will be expedited by the minimal technical rules proposed in the NPRM — the rush to market will be on. Apple therefore supports the Commission's decision to limit the restrictions imposed on devices operating in the mm wave bands and urges the Commission to adopt its proposed Part 15 rules as written, except as discussed in Section III, *infra*.

⁷ The Commission is well aware of the constraints imposed by the rules governing existing radio communications services, as well as of the special technical requirements for communicating in the mm wave bands. See NPRM at n.12 (suggesting that bandwidth limitations, modulation techniques and signal-to-noise ratios act as constraints on high data-rate transmissions via existing radio communications systems). An associated prevailing phenomenon of non-line-of-sight propagation, particularly for in-building applications, is that of multipath effects. Achieving coaxial-cable and fiber-optic data rates in a wireless medium is not simple. The Commission's assertion of a "high current cost for [mm wave] technology," NPRM at ¶ 21, is valid with respect to both licensed and unlicensed services.

⁸ The Commission adopted rules for unlicensed spread spectrum communications in the so-called "ISM" bands, on May 9, 1985. The first equipment authorization under those new rules was not granted until more than three years later, on August 10, 1988. The rules were further developed in July, 1990, generally increasing the scope of technologies that could be used. Notable growth of band usage was delayed until 1992-93, during which numerous products began to appear in the market.

III. THE COMMISSION SHOULD MODIFY ITS PROPOSED POWER LIMITS.

While limiting the radius of communications signals makes it much easier to control interference, there are important unlicensed applications that cannot be confined to a single room, or a single building, or even a single campus. Apple encourages the Commission to recognize that not all worthwhile unlicensed applications are necessarily “short range.” In particular, one of the most urgent unfulfilled requirements for unlicensed radio links is for “community networks,” which could be used to join rural populations or to connect individuals to the Internet even where no high-speed telephone lines or cable networks are available.

To fill this need, the Commission should examine whether some of the unlicensed mm wave bands could support longer range communications services. In addition, the Commission should consider whether higher EIRP transmitters using highly directional antennas should be permitted to operate in some of these bands.⁹ Finally, authorized power levels should take into account the generalization that larger information bandwidths require more power for a given distance, whether multi-level modulation techniques or wider RF bandwidths are used. Thus, a power limit equivalent to 0.25 watts EIRP¹⁰ may be appropriate for hand-held and desktop devices, but may be inadequate to support campus-wide or community networks.

To the extent that it is necessary to preclude human exposure to excessive RF signals, higher-power links might be permitted only when certain requirements for antenna placement are fulfilled, as the NPRM suggests.¹¹

⁹ Highly directional antennas could be easily implemented at mm wave frequencies. In addition, some of the most beneficial developments for the mm bands could be in antenna technologies, including “smart” configurable arrays.

¹⁰ See NPRM at n. 35.

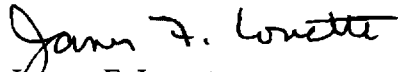
¹¹ See NPRM at ¶ 40.

CONCLUSION

Apple commends the Commission's efforts to open the mm wave bands to non-governmental uses, and supports the NPRM's proposed allocations and Part 15 technical rules (except as discussed in Section III). Apple therefore urges the Commission to act expeditiously to adopt the proposals set forth in the NPRM, with the modifications suggested herein.

Respectfully submitted,

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